IN THE SPECIFICATIONS

Please insert the following at page 2, line 1:

CROSS REFERENCES TO RELATED APPLICATIONS

This application is a continuation of United States Patent Application Ser. No. 09/928,768 filed on August 13, 2001, now United States Patent 6,727,696.

Please amend paragraph **[0018]** as shown:

[0018] During drilling operations, a suitable drilling fluid **31** from a mud pit (source) **32** is circulated under pressure through a channel in the drillstring **20** by a mud pump **34.** The drilling fluid passes from the mud pump **34** into the drillstring **20** via a ~~desurger 36~~ desurger (not shown), fluid line **28** and Kelly joint **21.** The drilling fluid **31** is discharged at the borehole bottom **51** through an opening in the drill bit **50.** The drilling fluid **31** circulates uphole through the annular space **27** between the drillstring **20** and the borehole **26** and returns to the mud pit **32** via a return line **35**. The drilling fluid acts to lubricate the drill bit **50** and to carry borehole cutting or chips away from the drill bit **50**. A sensor S_1 preferably placed in the line **38** provides information about the fluid flow rate. A surface torque sensor S_2 and a sensor S_3 associated with the drillstring **20** respectively provide information about the torque and rotational speed of the drillstring. Additionally, a sensor (not shown) associated with line **29** is used to provide the hook load of the drillstring **20.**

Please amend paragraph **[0021]** as shown:

[0021] In one embodiment of the invention, a drilling sensor module **59** is placed near the drill bit **50.** The drilling sensor module contains sensors, circuitry and processing software and algorithms relating to the dynamic drilling parameters. Such parameters preferably include bit bounce, stick-slip of the drilling assembly, backward rotation, torque, shocks, borehole and annulus pressure, acceleration measurements and other measurements of the drill bit condition. A suitable telemetry or communication sub **72** using, for example, two-way telemetry, is also provided as illustrated in the drilling assembly ~~**100**~~ **90**. The drilling sensor module processes the sensor information and transmits it to the surface control unit **40** via the telemetry system **72**.

Please amend paragraph **[0025]** as shown:

[0025] The MWD tool **79**, including an associated pulsed NMR tool **77** having a sensor assembly **113**, and the pulsed power unit **78** are connected in tandem in the drilling assembly **90**. The MWD tool **79** may also include a sonic sensor, a density measurement tool, and a porosity measurement tool. As seen in **Fig. 3**, the NMR tool **77** is rotationally symmetric about a longitudinal axis **128** of the drilling assembly ~~**100**~~ **90**. The longitudinal member is, for example, a drill pipe section **101**, which forms the core of the segment **70**. Alternatively, the longitudinal member is a shaft in a downhole directional drilling assembly. The drill pipe section **101** is connected to the drillstring **20** by the upper tool joint **103** and the lower tool joint **139,** and has a channel or flow pass **105** for the drilling mud to flow downhole. The sensor assembly **113** surrounds the drill pipe

section **101** and is slidably coupled to the longitudinal member or the drill pipe section **101**. The sensor assembly **113** is coupled to the drill pipe section **101** by at least one of guide sleeves **109** and **111**. The guide sleeves **109** and **111** include, for instance, slip rings and bearings **110** and **112**, respectively. Alternatively, a single guide sleeve (not shown) including slip rings and bearings, is used, for example, centrally located between ends of the sensor assembly **113**. The guide sleeves **109** and **111** allow the sensor assembly **113** to move freely in the axial direction and to a lesser extent laterally with respect to the drill pipe section **101**. The sensor assembly **113** has an outer diameter that is somewhat less than the inner diameter of the borehole **26**. For illustrative purposes, **Fig. 3** shows the space between the sensor assembly **113** and the borehole wall in an exaggerated manner. The NMR sensor assembly includes flow paths **107** and **114** for return flow of the drilling mud from the drilling assembly **90** below wherein the gap between the sensor assembly **113** and the borehole wall are minimized.

Please amend paragraph **[0031]** as shown:

[0031] The device of *Kruspe* thus comprises a sensor assembly mounted on a slidable sleeve slidably coupled to a longitudinal member, such as a section of drill pipe. When the sensor assembly is held in a non rotating position, for instance for obtaining the measurements, the longitudinal member is free to rotate and continue drilling the borehole, wherein downhole measurements can be obtained with substantially no sensor movement or vibration. This is particularly useful in making NMR measurements due to their susceptibility to errors due caused by tool vibration. A clamping device is used, for

instance, to hold the sensor assembly is held in the non rotating position. Also disclosed in *Kruspe* but not shown in **Fig. 3** is the use of one or more thrusters for axial decoupling of the sensor assembly from the drillstring. **Figure 4** illustrates the use of a thruster **350** below the drill pipe section with the sensor assembly **113.**

Please amend paragraph **[0007]** as indicated:

[0007] Immediately following the application of the "flipping" RF magnetic field, the spin vectors are all pointing in the same direction, and ideally as they precess, they should continue to point in a common direction. In real situations, the strength of the static field is inhomogeneous in space. As a result, the spins will tend to precess at different rates. The different precession rates ~~causes~~ cause the vector sum of the magnetization in the plane of the spins to decay to zero. This decay of the spin magnetization in the plane perpendicular to the static field is known as the free induction decay (FID) and is characterized by its decay rate, T_2*. A simple method comprised of another magnetic pulse with twice the duration of the first pulse flips the spin vectors 180 degrees. After the flip, the leading spins now find themselves behind the other spins and the lagging spins find themselves at the front of the diffusion. As a result, the magnetization vectors begin to reconverge. At some later time, all the spin vectors are aligned again in the same direction. This realignment creates a "spin echo" which can be recorded as an induced voltage in the receiver coil. As the time between the excitation pulse and the realignment pulse is increased, the spin echo amplitude decays. Neglecting microscopic molecular diffusion, the characteristic decay time is known as the spin-spin or transverse relaxation

time and is denoted as T_2. The amplitude of the spin echoes can be used to determine spin density, T_1 and T_2.

Please amend paragraph **[0023]** as indicated:

[0023] It is the intention of the design that the transmission coil is longer along the z-axis than the full possible extent of the receiver coils. Separating the transmission coil and the receiver coil from each other, and simultaneously increasing the overall area of the transmission coil over that of the receiver coil ~~overcome~~ <u>overcomes</u> many prior constraints. As an example, in prior art, a single coil acts as transmitter and receiver and cycles from one mode of operation to the other. In this prior design, when the coil is in receiver mode, substantial amounts of fluid which have not been excited by the initial pulse in the cycle can move into the sensitive region. As a result, some of the nuclei observed during the receiving portion of the cycle are not properly oriented and become a source of error. This error becomes greater as the longitudinal speed of the NMR device allowing more untreated spins to move into the region. As a result, this phenomenon imposes a practical upper limit to the effective logging speed of prior art. Separating the roles of the transmission and receiver cycles addresses this problem.

Please amend paragraph **[0028]** as indicated:

[0028] An embodiment of the invention allows for the ability to create azimuthal images of the borehole, providing greater detail. Utilizing many sensors gives this invention an advantage over prior art. Multiple sensors can be arrayed along the circumference of the borehole logging tool. In a preferred embodiment for this purpose, the tool has four sensors extending around the circumference of the tool, each of which can be placed against the wall of the borehole. Measurements made by the individual sensors may be analyzed to give relative dip information using known methods. Further detail can be achieved by rotating the sensor assembly by 90^0 ~~along its longitudinal axis~~, thereby orienting the assembly tangentially to the logging tool. This is shown in **Fig. 3** where the sensor is rotated so that the y-axis is now parallel to the tool axis and the direction of motion while logging is along the y-axis. The z-axis of sensor may be deformed into an arc so that the sensor front more closely conforms to the borehole wall when pressed against it. The multiple (three are shown) receiver coils are now spaced along the circumference of the borehole and provide azimuthal resolution. As an example, for an 8.5-inch borehole, a sufficient imaging device would require four sensor assemblies, with six coils per sensor, with each coil being one inch in length. An azimuthal sensing capability is taught in U.S. Patent 5, 977,768 to *Sezginer* et al in the context of a measurement-while-drilling tool. Measurements are made over a limited circumferential sector. This makes it possible in near horizontal boreholes to differentiate between two proximate beds with different porosities. The *Sezginer* device does not, however, have

the resolution of the present invention and is not designed for high speed logging.